

299-E13-52 (A5868) Log Data Report

Borehole Information:

Borehole: 299-E13-52 (A5868)		Site: 216-B-30 Trench			
Coordinates (WA State Plane)		GWL: (ft)¹: Not deep enough	GWL Date: 6/11/03		
North	East	Drill Date	TOC² Elevation	Total Depth (ft)	Type
134,400.9 m	573,089.76 m	Dec. 1965	227.607 m	94	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	1.85	7	6 5/8	3/16	+1.85	94
The logging engineer measured the casing stickup using a steel tape. A caliper was used to determine the outside casing diameter. The caliper and inside casing diameter were measured using a steel tape. Measurements were rounded to the nearest 1/16 in. Casing thickness was calculated.						

Borehole Notes:

Borehole coordinates, elevation, and well construction information are from measurements by Stoller field personnel, HWIS³, and Chamness and Merz (1993). Zero reference is the top of the casing.

Logging Equipment Information:

Logging System:	Gamma 2E	Type:	SGLS (70%)
Calibration Date:	3/2003	Calibration Reference:	GJO-2003-430-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Logging System:	Gamma 1C	Type:	High Rate Detector
Calibration Date:	04/2003	Calibration Reference:	GJO-2003-429-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2/Repeat	3	4	
Date	6/12/03	6/12/03			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	94.0	69.0			
Finish Depth (ft)	2.0	59.0			
Count Time (sec)	100	100			
Live/Real	R	R			
Shield (Y/N)	N/A ³	N/A			
MSA Interval (ft)	1.0	1.0			
ft/min	N/A	N/A			

Log Run	1	2/Repeat	3	4	
Pre-Verification	BE038CAB	BE038CAB			
Start File	BE038000	BE038093			
Finish File	BE038092	BE038103			
Post-Verification	BE039CAA	BE039CAA			
Depth Return Error (in.)	0	0			
Comments	No fine-gain adjustment.	Repeat section.			

High Rate Logging System (HRLS) Log Run Information:

Log Run	1	2/Repeat			
Date	10/17/03	10/17/03			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	28.0	15.0			
Finish Depth (ft)	10.0	11.0			
Count Time (sec)	300	300			
Live/Real	R	R			
Shield (Y/N)	None	None			
MSA Interval (ft)	1.0	1.0			
ft/min	N/A	N/A			
Pre-Verification	AC077CAB	AC077CAB			
Start File	AC077000	AC077019			
Finish File	AC077018	AC077023			
Post-Verification	AC077CAA	AC077CAA			
Depth Return Error (in.)	N/A	0			
Comments	No fine-gain adjustment.	Repeat section.			

Logging Operation Notes:

Zero reference was top of the casing. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K , ^{238}U , and ^{232}Th) verifier with serial number 082. Pre- and post-survey verification measurements were acquired for the HRLS in the ^{137}Cs verifier SN 1013. During logging, fine-gain adjustments were not needed.

Analysis Notes:

Analyst:	Sobczyk	Date:	10/22/03	Reference:	GJO-HGLP 1.6.3, Rev. 0
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SGLS pre-run and post-run verification spectra were collected at the beginning and end of the day. All of the verification spectra were within the control limits. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 3 percent lower and 2 percent higher at the end of the day.

HRLS pre-run and post-run verification spectra were collected at the beginning and end of the day. The spectra were within the acceptance criteria for the field verification of the Gamma 1C logging system (HRLS).

Log spectra for both the SGLS and HRLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. The pre-run verification spectrum was used to determine the energy and resolution calibration for processing the SGLS data using APTEC

SUPERVISOR. Concentrations were calculated in EXCEL (source files: G2EMar03.xls and G1CApr03.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the casing. On the basis of Chamness and Merz (1993), the casing configuration was assumed to be one string of casing to the maximum depth of the logging (94 ft). The casing correction factor was calculated assuming a casing thickness of 0.25 in. This casing thickness was used for direct comparison with the 1999 RLS logging event, which also used a casing thickness of 0.25 in. For ^{137}Cs (based on 662 keV), use of a 0.25-in. casing thickness instead of 3/16 in. would overestimate ^{137}Cs concentrations by approximately 11 percent. A water correction was not required.

Using the SGLS, dead time greater than 40 percent was encountered in the interval from 11 to 24 ft and at 27 ft. Data from these regions were considered unreliable. At SGLS dead time greater than 40 percent, peak spreading and pulse pile-up effects may result in underestimation of activities. This effect is not entirely corrected by the dead time correction, and the extent of error increases with increasing dead time. SGLS dead time corrections were applied when dead time reached 10.5 percent. The HRLS was utilized to obtain data where the SGLS dead time exceeded 40 percent.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K , ^{238}U , and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. In addition, a comparison log plot of man-made radionuclides is provided to compare the data collected in 1999 by Waste Management Federal Services Northwest's Radionuclide Logging System (RLS) with SGLS data. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs , ^{60}Co , and ^{154}Eu were the man-made radionuclides detected in this borehole. ^{137}Cs was detected near the ground surface (4 ft) to the bottom of the borehole (94 ft). The range of concentrations was from the MDL (0.2 pCi/g) to 123,000 pCi/g, which was measured at 12 ft. ^{60}Co was detected almost continuously in the interval from 33 to 94 ft. Concentrations ranged from near the MDL (0.1 pCi/g) to 1.8 pCi/g. The maximum concentration of 1.8 pCi/g was measured at 87 ft. ^{154}Eu was detected at 21 ft with a concentration of 3 pCi/g.

Recognizable changes in the KUT logs occurred in this borehole. A change of 5 pCi/g in apparent ^{40}K concentrations occurs between 48 and 52 ft.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the man-made radionuclides (662, 1173, and 1333 keV) and natural radionuclides (609, 1461, 1764, and 2614 keV). The ^{232}Th concentration based on the 2614-keV photopeak does not repeat at 62 ft. At 64 ft, the ^{40}K concentration and ^{60}Co concentration based on the 1173-keV photopeak did not repeat. The plot of the repeat log demonstrates reasonable repeatability of the HRLS data for ^{137}Cs (662 keV).

Comparison log plots of data collected in 1999 by Waste Management Federal Services Northwest and in 2003 by Stoller are included. The RLS concentration data for ^{137}Cs , ^{60}Co , and ^{154}Eu are decayed to the date of the SGLS logging event in June 2003. Comparison of the ^{137}Cs and ^{60}Co concentrations indicates that the RLS and the recent (SGLS and HRLS) data appear to agree for these radionuclides. Due to relatively high ^{137}Cs concentrations and relatively low ^{154}Eu concentrations, comparison of the SGLS and RLS between 8

and 32 ft cannot be made. Since 1999, ^{137}Cs , ^{60}Co , and ^{154}Eu activities have decreased as predicted by radioactive decay.

References:

Chamness, M.A., and J.K. Merz, 1993. *Hanford Wells*, PNL-8800, Pacific Northwest Laboratory, Richland, Washington.

¹ GWL – groundwater level

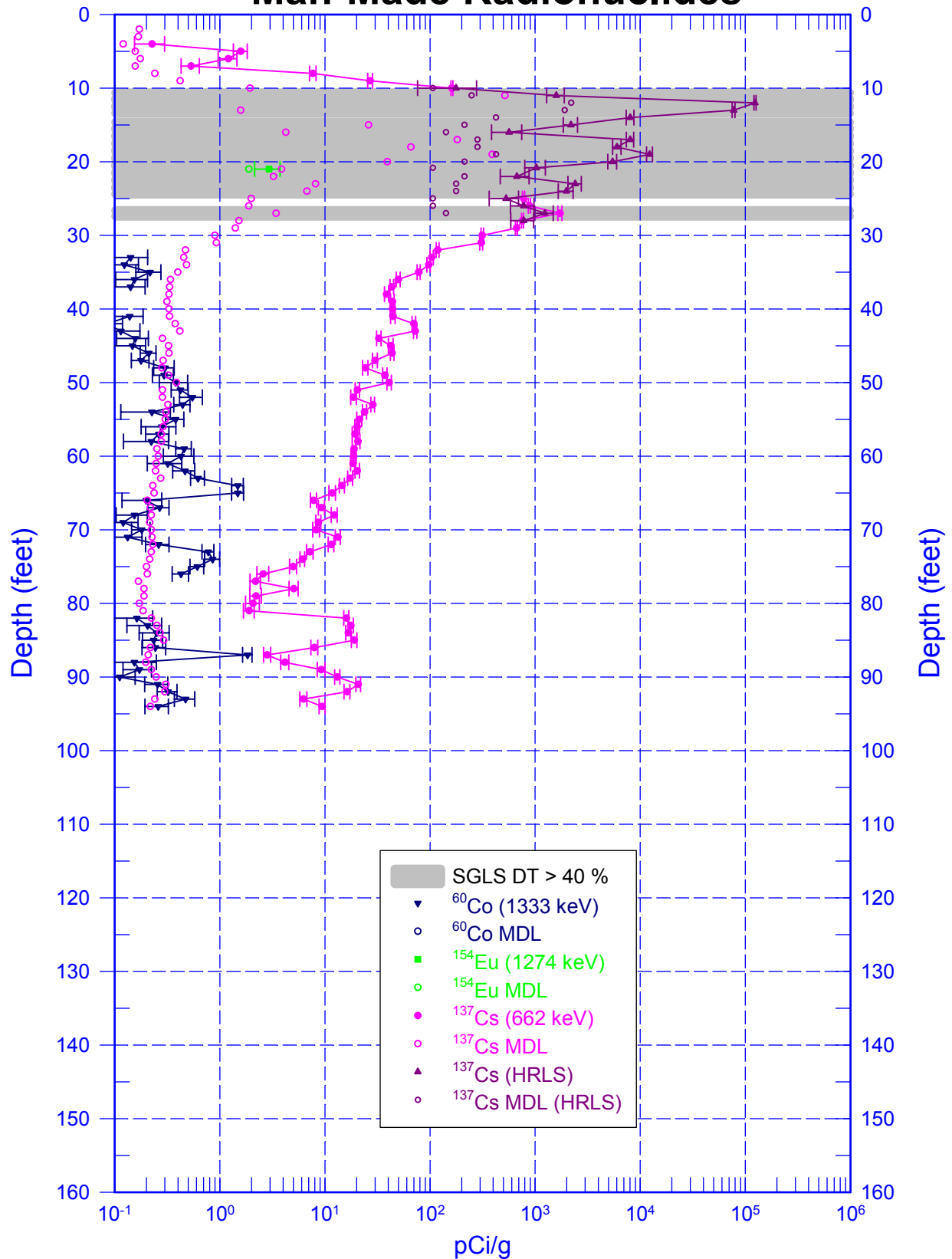
² TOC – top of casing

³ HWIS – Hanford Well Information System

⁴ N/A – not applicable

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Man-Made Radionuclides

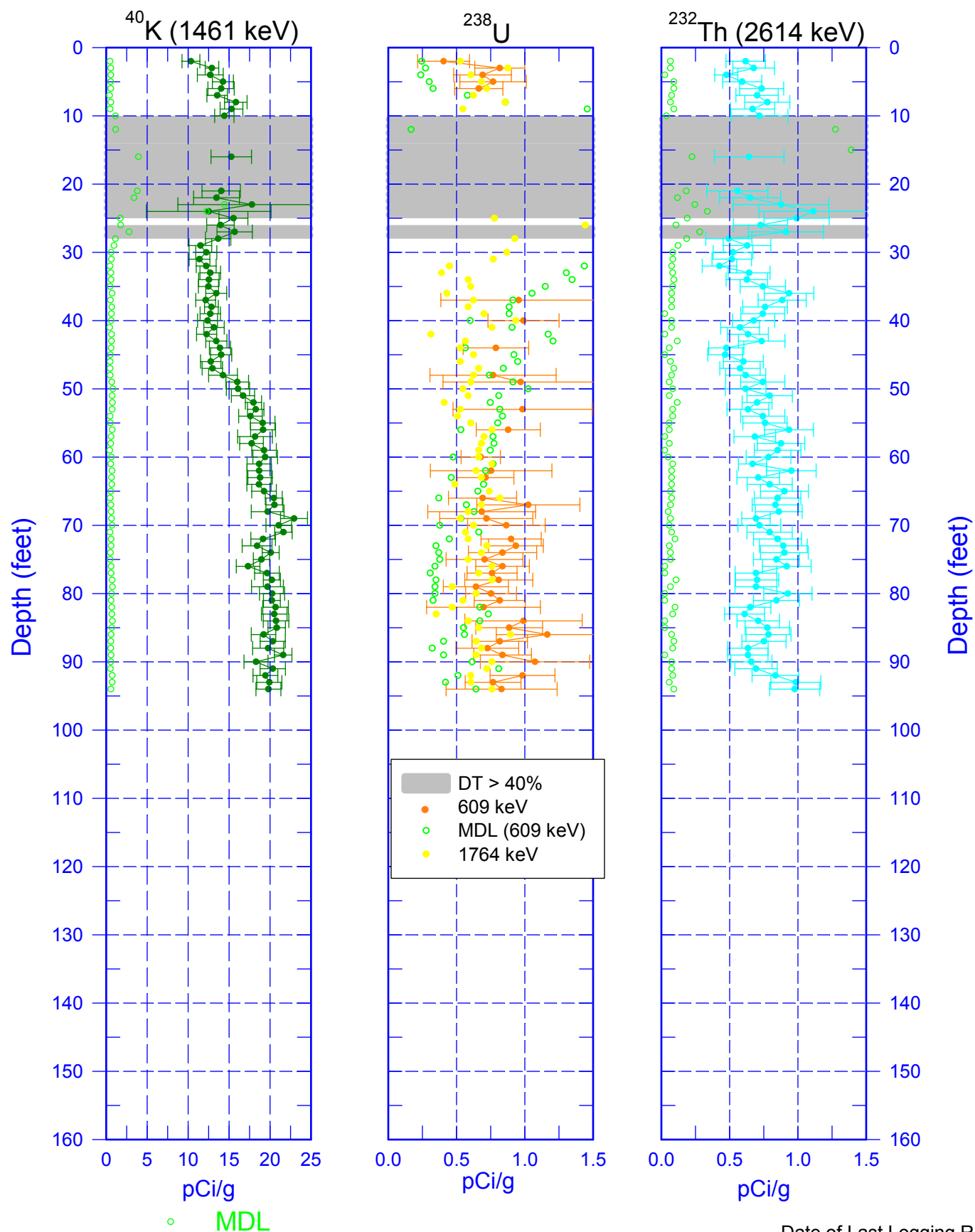


Zero Reference = Top of Casing

Date of Last Logging Run
10/17/2003

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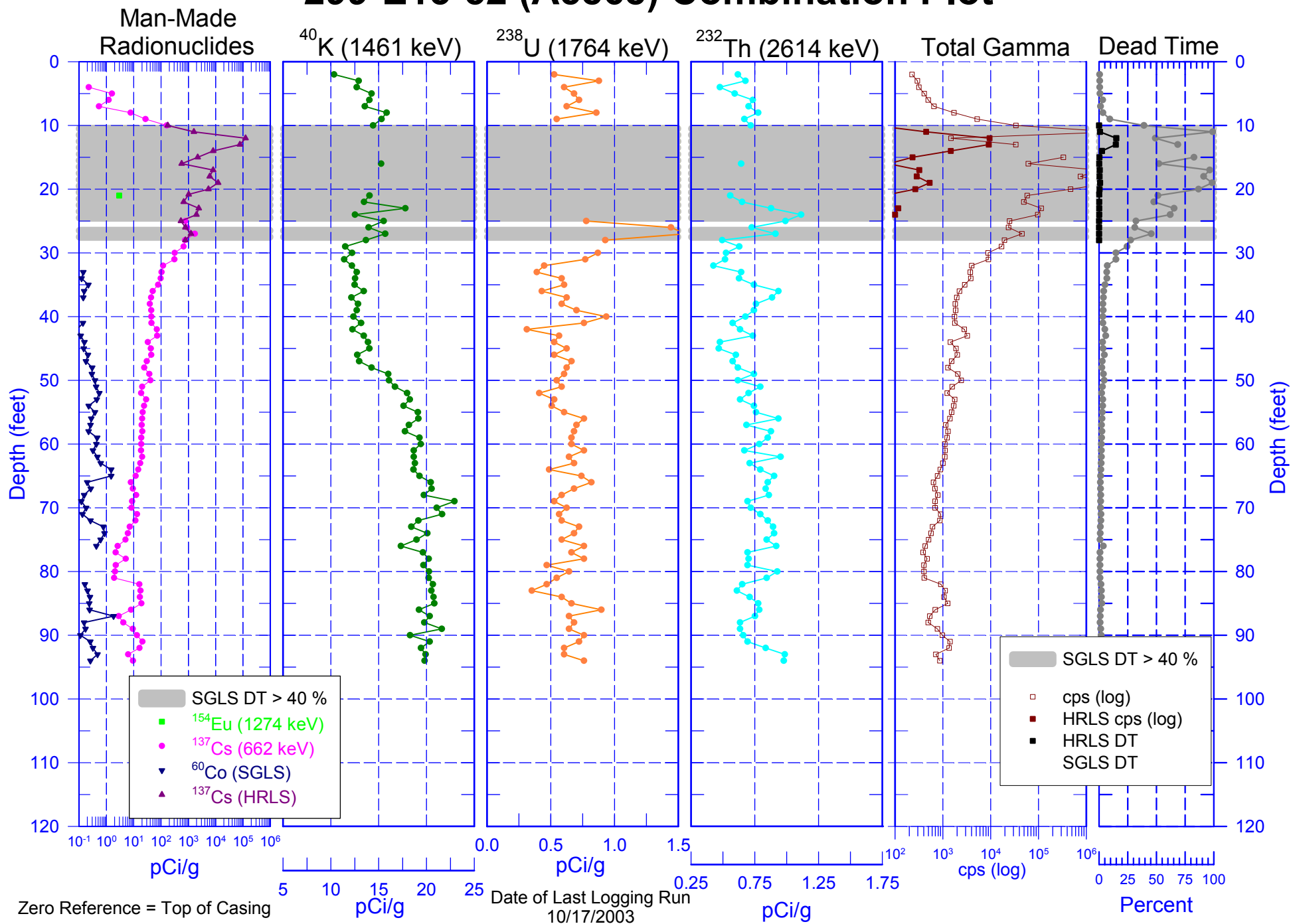
Natural Gamma Logs



Zero Reference = Top of Casing

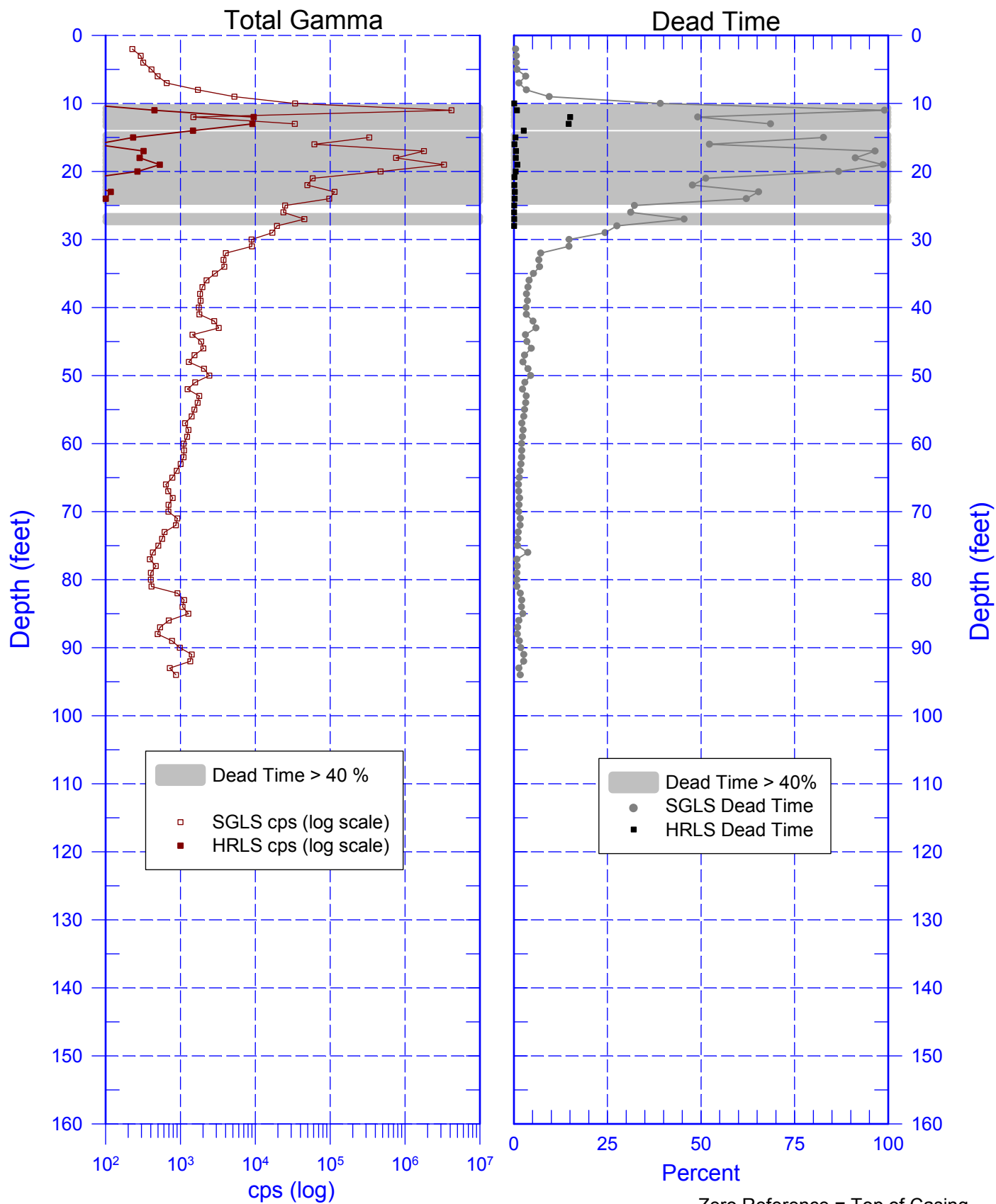
Date of Last Logging Run
6/12/2003

299-E13-52 (A5868) Combination Plot



299-E13-52 (A5868)

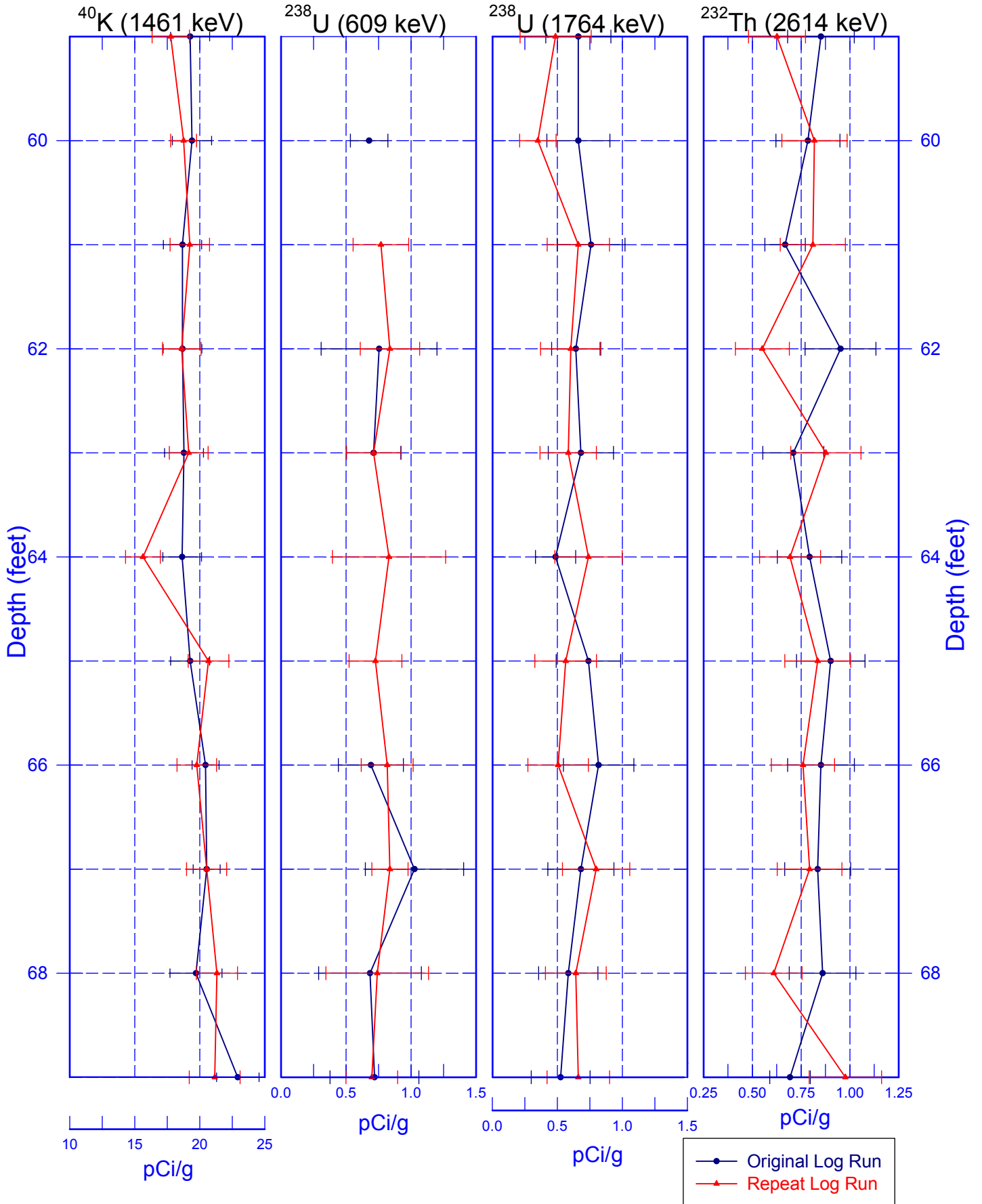
Total Gamma & Dead Time



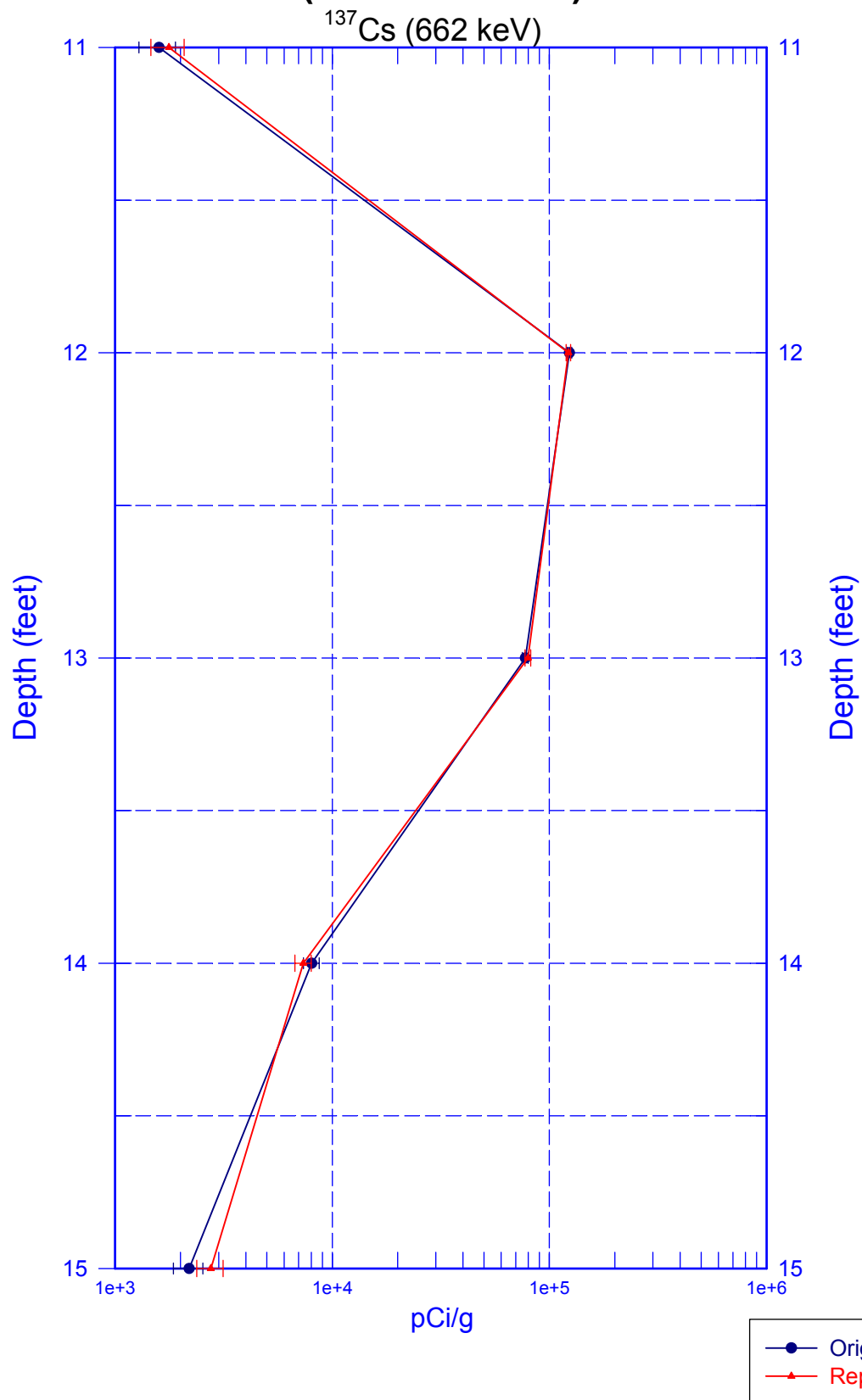
Zero Reference = Top of Casing
Date of Last Logging Run
10/17/2003

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Rerun of Natural Gamma Logs (69.0 to 59.0 ft)

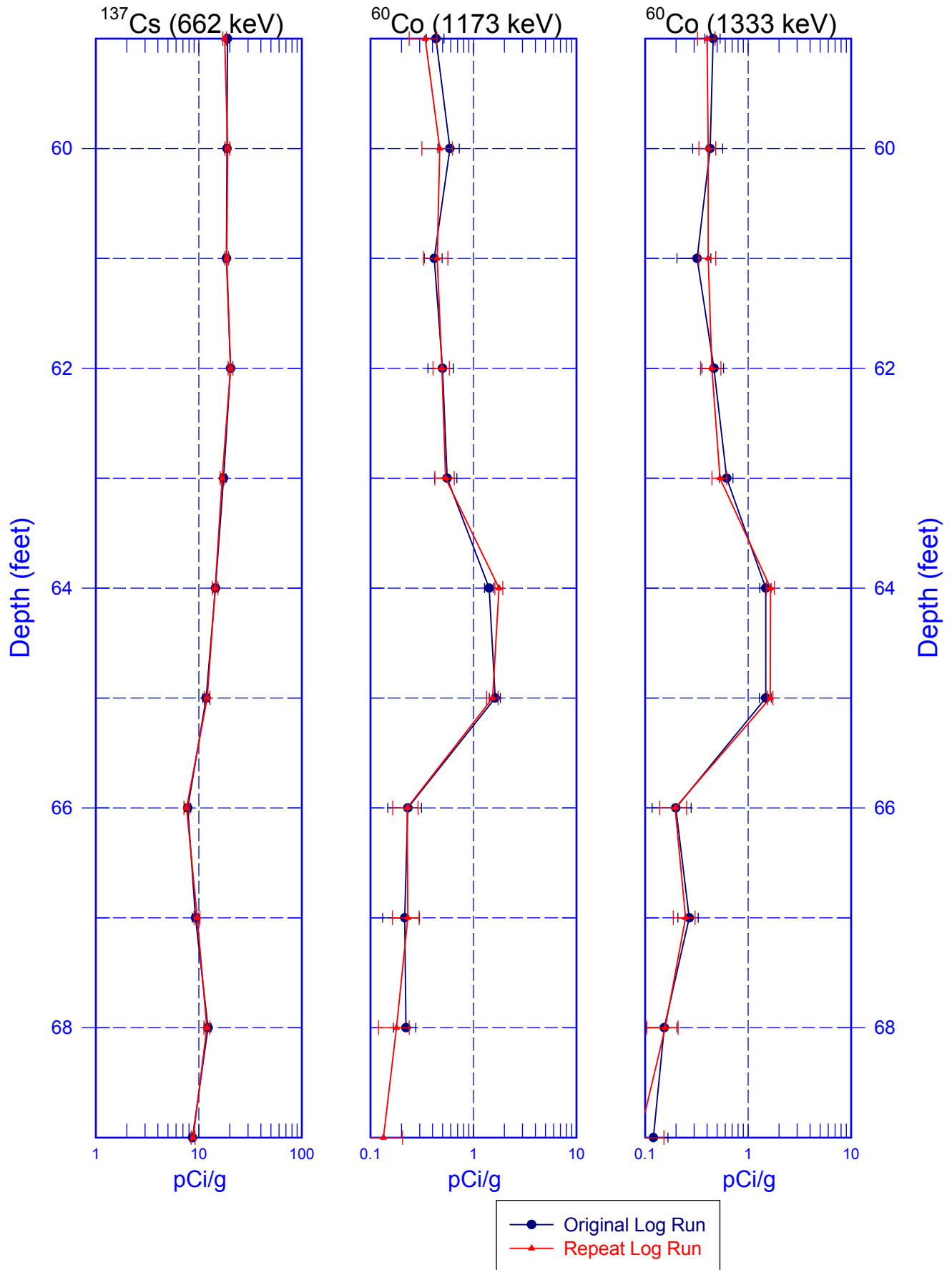


299-E13-52 (A5868)
High Rate Logging System
Rerun of Man-Made Radionuclides
(15.0 to 11.0 ft)



299-E13-52 (A5868)

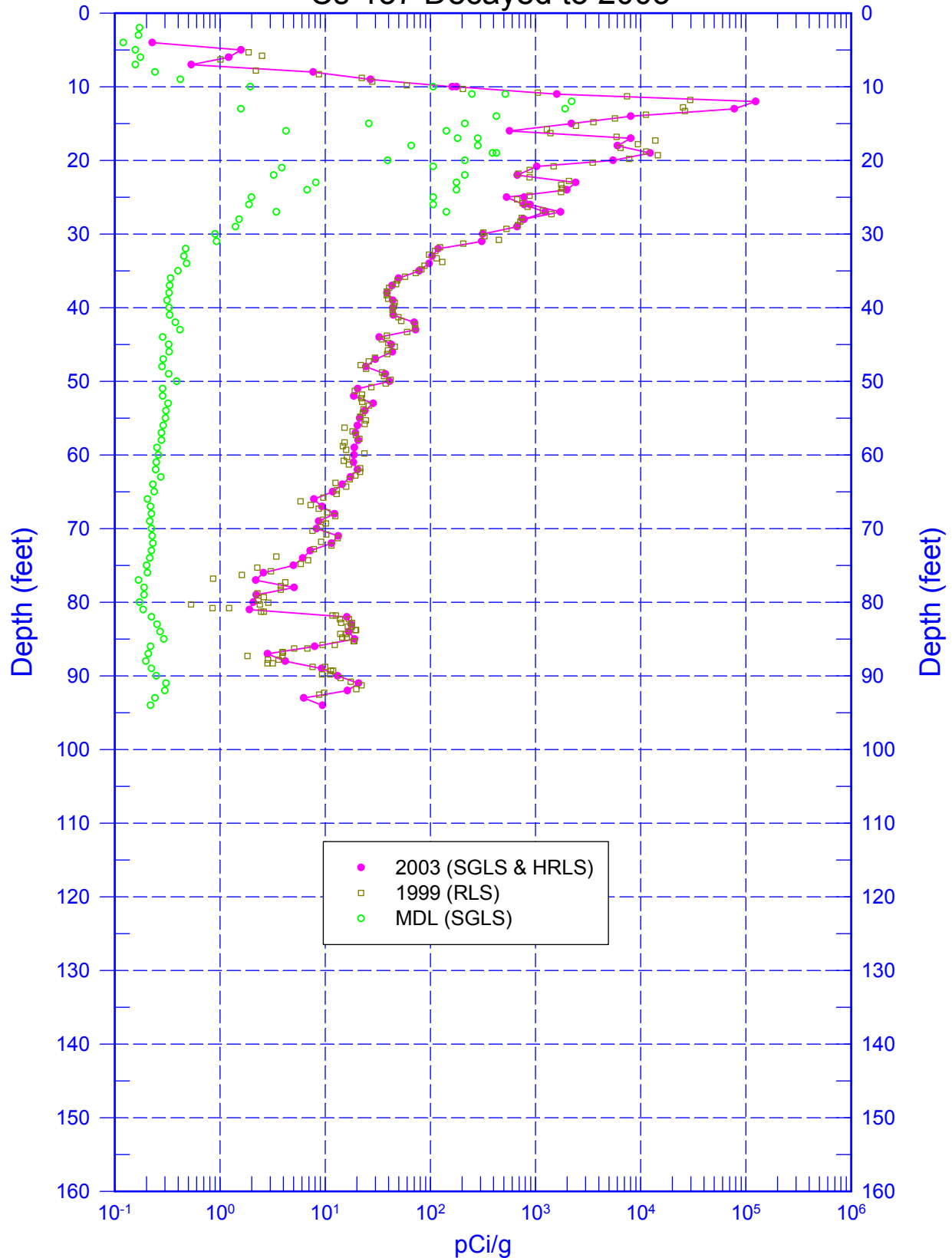
Rerun of Man-Made Radionuclides (69.0 to 59.0 ft)



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RLS Data Compared to SGLS Data

Cs-137 Decayed to 2003

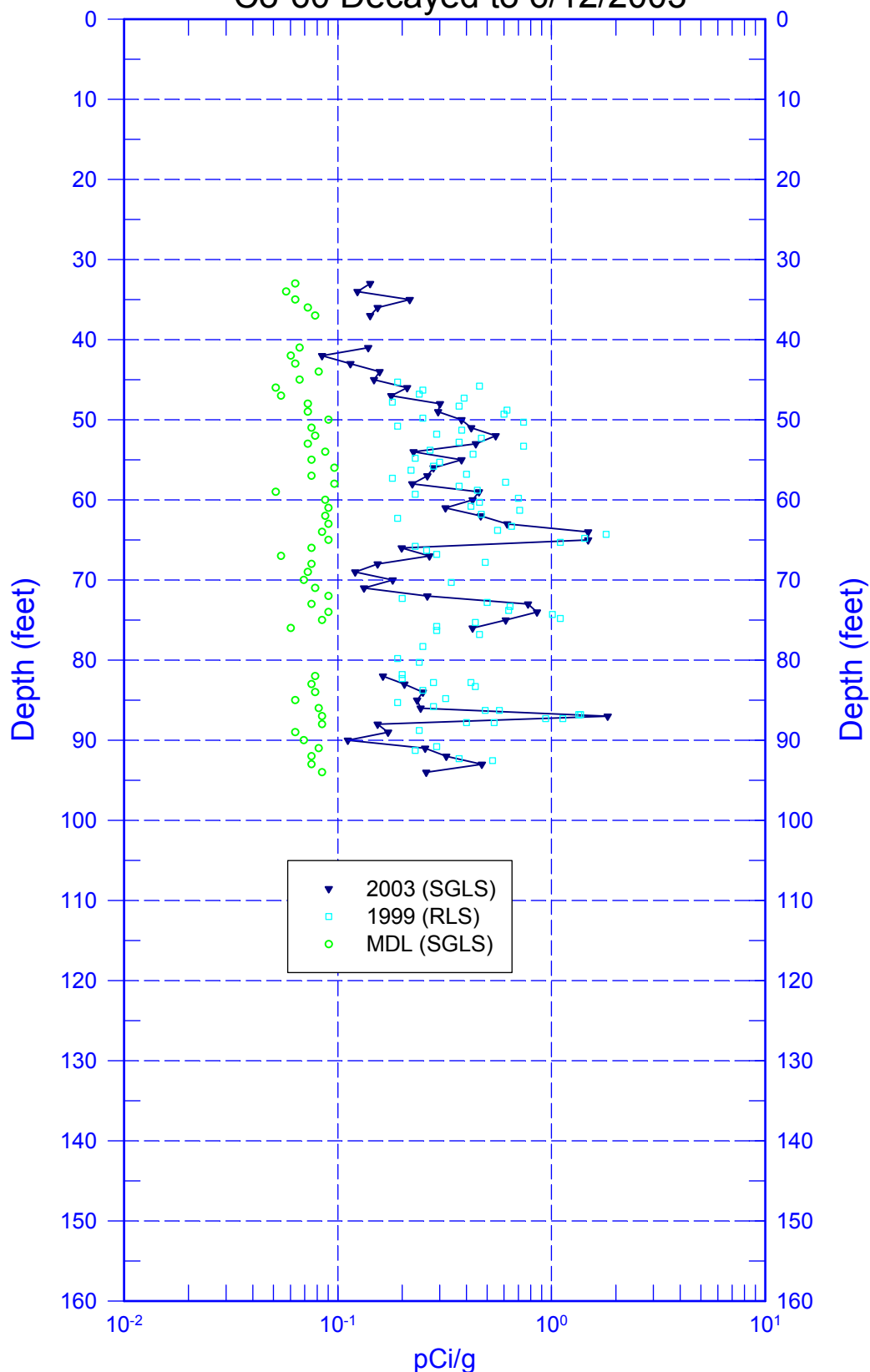


Zero Reference = Top of Casing (2003 SGLS & 1999 RLS)
1999 RLS shifted +1.85 ft to align with the SGLS

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RLS Data Compared to SGLS Data

Co-60 Decayed to 6/12/2003

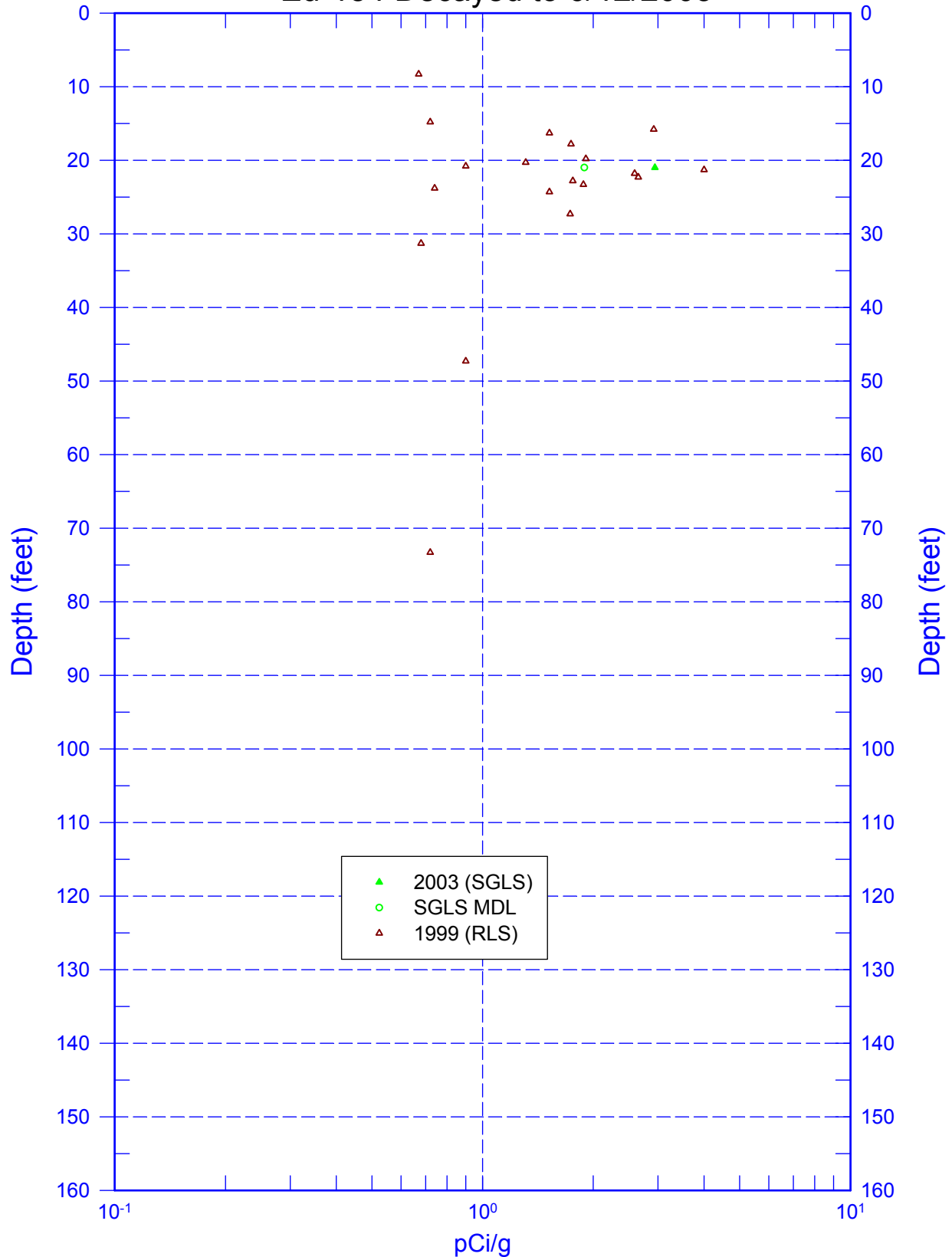


Zero Reference = Top of Casing (2003 SGLS)
1999 RLS data shifted +1.85 ft to align with 2003 SGLS

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RLS Data Compared to SGLS Data

Eu-154 Decayed to 6/12/2003



Zero Reference = Top of Casing (2003 SGLS)
1999 RLS shifted +1.85 ft to align with the SGLS